Amendments to the claims

1. (Amended) An integrated optical router, comprising:

a substrate;

a plurality *K* of first arrayed waveguide gratings formed in said substrate and configured as optical demultiplexers each including at least one first input and *W* first outputs;

a plurality *K* of second arrayed waveguide gratings formed in said substrate and configured as optical multiplexers each including at least *W* second inputs and one second ~~outputs~~ <u>output</u>;

a third arrayed waveguide grating formed in said substrate and having *WK* third inputs and *WK* third outputs;

a plurality *WK* of first wavelength converters at least partially formed in said substrate between respective ones of said first outputs and said third inputs; and

a plurality *WK* of second wavelength converters at least partially formed in said substrate between respective ones of said third outputs and said second inputs.

2. The optical router of Claim 1, wherein said substrate includes an InP base and semiconductor layers epitaxially formed thereover.

3. The optical router of Claim 1, wherein said first and second wavelength converters each include a Mach-Zehnder interferometer including active regions formed in said substrate.

4. <u>The optical router of Claim 1, wherein said substrate is bonded to a single thermoelectric cooler</u>.

5. The optical router of Claim 3, wherein said first and second wavelength converters each include a tunable laser.

6. The optical router of Claim 5, wherein said tunable lasers are formed in said substrate.

7. The optical router of Claim 3, further comprising at least one electronic chip bonded to said substrate and electrically connected to said active regions and said active regions.

Cont

8. (Amended) An ~~integrated~~ optical router, comprising:

~~a substrate;~~

a plurality K of optical splitters wavelength dividing a received optical signal into a first splitter port for wavelengths within a first silica fiber band and into a second splitter port for wavelengths within a different second silica fiber band;

a plurality K of optical detectors receiving and detecting optical signals from respective ones of said first splitter ports;

a plurality K of first arrayed waveguide gratings each including a first input port receiving optical signals from respective ones of said second splitter ports and further including at least W first output ports;

a second arrayed waveguide grating including WK second input ports optically connected to respective ones of said first output ports and further including WK second output ports;

a plurality K of third arrayed waveguide gratings each including W third input ports optically connected to respective ones of said second output ports and further including a third output port;~~.~~

a plurality K of lasers emitting light at a wavelength within said first silica fiber band; and

a plurality *K* of optical combiners and each having a first combiner input port receiving radiation from a respective one of said lasers and a second combiner input port connected to respective ones of said third output ports and further including an combiner output port output radiation received on said first and second combiner input ports.

9. The router of Claim 8, further comprising:

WK tunable first wavelength converters disposed between respective pairs of said first output ports and said second input ports; and

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WK tunable second wavelength converters disposed between respective pairs of said second output ports and said third input ports.

10. The router of Claim 9, further comprising a substrate in which said dividers, said combiners, and said first, second and third arrayed waveguides are formed.

11. A method of optically routing packets, comprising the steps of:

a first step of impressing onto a silica optical fiber packet signaling information for a first packet on a signaling optical signal having a signaling wavelength within a first silica fiber band;

a second step of impressing onto said silica optical fiber a data payload for said first packet on a first optical signal having a first wavelength within a different second silica fiber band;

detecting from said silica optical fiber said signaling optical signal; and

based upon said detecting spatially switching said first optical signal without converting it to electrical form.

12. The method of Claim 11, further comprising:

a third step of impressing onto said silica optical fiber packet signaling information for a second packet on a second optical signal having said signaling wavelength;

a fourth step of impressing onto said silica optical fiber a data payload for said second

packet on a second optical signal having a second wavelength different from said first wavelength within said second silica fiber band; and

based upon said detecting step spatially switching said second optical signal without converting it to electrical form.

13. The method of Claim 12, wherein said first and third impressing steps include impressing first and second RF signals upon said second optical signal.

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14. A method of optically routing packets, comprising the steps of:

at a first time, impressing onto an optical transmission path packet signal information for a first packet on a first optical signal having a first wavelength;

at a second time later than said first time by a predetermined time difference, impressing onto said optical transmission path a data payload for said first packet on a second optical signal having a different second wavelength;

detecting from said optical transmission path said first optical signal;

processing said detected first optical signal to determine a switching path, wherein said processing may be performed within a time period of no more than said time difference; and

switching said second optical signal according said determined switching path without converting it to electrical form.

15. The method of Claim 14, wherein said first and second wavelengths are different silica transmission bands.

16. (Canceled)

17. A method of optically routing packets, comprising the steps of:

first step of impressing upon an optical transmission path a multi-wavelength signal comprising a plurality of optical data channels of different first optical wavelengths, each of said

channels carrying a sequence of packet payloads;

second step of impressing upon said optical transmission path an optical control signal containing directional information for switching of all of said packet payloads and carried at a second optical wavelength different from said first optical wavelengths;

detecting from said optical transmission path said optical control signal; and

based upon said directional information, switching said packet payloads in different spatial directions without converting said multi-wavelength signal to electronic form.

18. The method of Claim 17, wherein said first impressing step comprises impressing a plurality of electrical subcarrier signals upon said first optical signal.

19. An optical router for a multi-wavelength signal including a first wavelength carrier containing switching information and at least two second wavelength carriers containing payload information, comprising:

one of more demultiplexers receiving said multi-wavelength signal and dividing them into a first optical path containing said first wavelength carriers and second and third optical paths containing respective ones of said second said second wavelength carriers;

an optical switching array including electrically controlled elements receiving said second and third optical paths and selectively connecting them to selected ones of output optical paths;

first and second optical delay lines disposed on said second and third optical paths between said demultiplexers and said switching array and capable of providing delays of at least 10ns;

a photodetector connected to said first optical path; and

control electronics receiving an output of said photodetector and controlling said electrically controlled elements to select a switching path through said optical switching array.

20. The optical router of Claim 19, wherein said optical delay lines have electrically

controllable delay times.

21. The optical router of Claim 19, wherein each of said optical delay lines comprises a planar waveguide including two cladding layers sandwiching an active layer including at least two quantum wells, a close packed hexagonal array of features being formed in said active layer and a series of defects being formed in said array along an axis of said waveguide.

22 – 23. (Canceled)

24. An optical router, comprising:

a plurality K of first arrayed waveguide gratings formed in said substrate and configured as optical demultiplexers each including at least one first input and W first outputs;

a plurality K of second arrayed waveguide gratings formed in said substrate and configured as optical multiplexers each including at least W second inputs and one second outputs;

a third arrayed waveguide grating formed in said substrate and having WK third inputs and WK third outputs;

a plurality WK of first wavelength converters at least partially formed in said substrate between respective ones of said first outputs and said third inputs; and

a plurality WK of second wavelength converters at least partially formed in said substrate between respective ones of said third outputs and said second inputs.

a plurality K of first arrayed waveguide gratings arranged in sectors in a first substrate and wavelength selectively connecting a first input port to a plurality of first output ports;

a plurality K of opto-electronic circuitries arranged in said sectors receiving optical inputs from said first output ports of a respective ones of said first arrayed waveguide gratings and including at least one control electrode;

a second arrayed waveguide grating receiving optical inputs from all of said opto-

electronic circuitries; and

a plurality of electronic control circuits formed in respective second substrates, bonded to said first substrates within respective ones of said sectors and connected to respective ones of said control electrodes.

25. The router of Claim 24, wherein said first substrate comprises an InP base and said second substrate comprises a GaAs base.

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26. The router of Claim 25, further comprising an electronic silicon circuit bonded to said first substrate and connected to all of said electronic control circuits.

27. (New) An optical router, comprising:

a plurality *K* optical demultiplexers each including at least one first input and *W* first outputs;

a plurality *K* optical multiplexers each including at least *W* second inputs and one second output;

a wavelength router having *WK* third inputs and *WK* third outputs;

a plurality *WK* of first wavelength converters connected between respective ones of said first outputs and said third inputs; and

a plurality *WK* of second wavelength converters connected between respective ones of said third outputs and said second inputs.

28. (New) The router of Claim 27, further comprising a substrate and wherein:

a. said optical demultiplexers comprise first arrayed waveguide gratings formed in said substrate;
b. said optical multiplexers comprise second arrayed waveguide gratings formed in said substrate; said wavelength router comprises a third arrayed waveguide grating formed in said substrate.

Cont'd

29. (New) The router of Claim 28, wherein said first and second wavelength converters are at least partially formed in said substrate.